# TEXTILE RESEARCH

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## IN THIS ISSUE

Industrial Research: What it Means to British Industry ..... 130

The Textile Technologist ..... 135

Industrial Fiber Society ..... 142

Thermal Properties of Moist Fabrics ..... 144

Device for Measuring Shrinkage of Hosiery ..... 150

Research Activities ..... 139

Research Aids ..... 143

Abstracts ..... 152

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# TEXTILE RESEARCH

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# In This Month's Issue

### Research in Great Britain

An English view of research may give us better perspective on our own situation. This article is an unusually clear and straightforward exposition of the place of industrial research in Great Britain. (See page 130.)

★ ★ ★

### The Textile Technologist

Wide-spread response to Douglas Woolf's article "The Executive and Technologist" indicates that many people share the author's belief that the relationship between the executive and technologist merits exploratory thought. (See page 135.)

★ ★ ★

### The Industrial Fiber Society

It is significant that the scope of this Society's interests is fibrous materials in general, their physical and chemical properties; their origin and manufacture; and the technological applications to industry. (See page 142.)

★ ★ ★

### Thermal Properties of Moist Fabrics

The degree of "chilling" or "clammy feel" of moist fabrics in contact with the body varies with different fibers and fabrics. Tests to evaluate this effect indicates that the extent of contact which the fabrics make with the skin is the significant factor. (See page 144.)

★ ★ ★

### Device for Measuring Shrinkage of Hosiery

Recent research at the National Bureau of Standards for the Military Services on the shrinkage of men's socks, necessitated the development of a special device for measurement of dimensions of socks not only in the relaxed condition but when stretched under loads comparable to those which socks may be subjected to in use. (See page 150.)

**An Excellent Perspective for American Industry is Presented in This English View of**

# Industrial Research

## What It Means to British Industry*

**By SIR HAROLD HARTLEY, F.R.S.**

*Vice-President of the London, Midland and Scottish Railway Company*

*An English view of research may give us better perspective on our own situation. This article is an unusually clear and straight-forward exposition of the place of industrial research in Great Britain.*
ARTHUR D. LITTLE, INC.

### The Need for Research in Industry

The prosperity of Britain after the war will depend more than ever before upon the efficiency and progressiveness of our industries. The loss of our foreign investments and the possible diminution of the payments to us from abroad for services rendered will necessitate a considerable expansion in the value of our exports if we are to increase or even maintain our standard of living. Furthermore, this increase in exports will have to be brought about despite the industrialization of other countries which before the war were mainly producers of raw materials. Success can only be won if our products are better, more attractive or cheaper than those made by our competitors or in our customers' own country.

Similarly, in the home market, our own products must hold their own, and we must make the most of the limited range of our native raw materials.

This formidable task can only be achieved by using to the full our inventiveness and technical skill both to increase the efficiency of our older industries and to develop new commodities which will hold their own in the markets of the world. In the nineteenth century our natural genius and craftsmanship gave us industrial supremacy, but we were then cultivating a virgin field and, until the close of the century, we had few competitors. Now the position is very different, not only because of the growth of industry abroad, but because the easy inventions and obvious developments have already been made. Nature now only yields her further secrets as a result of much more prolonged and careful searching. Haphazard enquiry must be replaced by organized and systematic study.

Only research can refashion existing industries effectively and create new ones. Developments sometimes occur with surprising rapidity, as was the case with radio and rayon, and everyone knows the remarkable scientific developments like radio-location which have occurred under the stress of war.

* This article is a condensation of a recent bulletin published by Arthur D. Little, Inc., and is presented here by permission of Arthur D. Little, Inc., chemists and engineers, 30 Memorial Drive, Cambridge 42, Massachusetts.

There is no reason why the post-war problems of industry should not equally be solved by scientific research, provided it is adequately supported.

In the future the advantages Britain possesses in the skill and traditions of her craftsmen will depend more and more on the science that directs their efforts. Labour and research must work hand in hand.

### Great Britain and Her Competitors

Germany and the United States are usually quoted as outstanding examples of countries which have utilised the services of science in the development of industry to a far greater extent than we have in Great Britain. Direct comparisons are difficult and misleading in that much valuable work has been done in the industries of this country without its being specifically termed industrial research, whereas Germany, and particularly the U. S. A., have given greater prominence and publicity to their industrial research activities which they have recognised as possessing a definite sales appeal. Nevertheless, despite some outstanding exceptions, in this country there has not been a general appreciation of the value of science in industry, and the amounts spent on research have been correspondingly less.

The published figures of expenditure upon research in America show that the amount spent by that country in 1940 ran into hundreds of millions of dollars.

Figures for war-time expenditure on research in this country are not available, but a study of pre-war expenditure by both countries shows without question that this country spent nothing like enough in comparison with the United States.

The greater use which the United States makes of scientific knowledge is strikingly reflected in the character of their exports which, to a far greater extent than the exports of this country, are the result of modern invention and design.

It is important to emphasise that these contrasts are in no way due to any lower standing of British science. In both the world wars British scientists have proved that they can more than hold their own if they are given equal facilities and support. All they need is the same opportunity in peace as in war.

*It is impossible to avoid the conclusion that if this country is to maintain its position in the world markets, our industries must greatly increase their attention to research as soon as the progress of the war makes it possible. There is danger in delay: markets once lost are not easily regained; and industrialists must be taking active steps now to organize this aspect of their post-war activities.*

### The Organisation of Research in Great Britain

At the present time research in Great Britain is carried on in five main groups of establishments:—

Laboratories of the universities and technical colleges.

Research Stations of the Department of Scientific and Industrial Research, and of the Agricultural and Medical Research Councils.

Research associations supported partly by industry but aided by grants from the D.S.I.R.

Research laboratories maintained by private firms.

Research establishments of the Fighting Services.

*(Continued on Next Page)*

1. **The laboratories of universities and technical colleges.**—Great industrial developments usually depend on fundamental discoveries; thus the electrical industry grew from Faraday's researches on electromagnetic induction, and the radio industry sprang from the work of Hertz on electro-magnetic waves carried out in a university. In more recent times the technique of radiolocation was first devised and used for a purely scientific purpose without any thought of its practical application. These examples illustrate in a striking way the unexpected practical significance of the by-products of pure scientific research.

It is in the university laboratories, the outposts on the frontiers of knowledge, that fundamental research is mainly done. At any time a new industry may be borne there which will meet some new human need. It is in the atmosphere of the university laboratory, too, that the men on whom we shall have to rely as leaders of industrial research are bred and trained.

Business therefore has a direct interest in seeing that research at universities and in technical colleges is adequately endowed.

2. **Research Stations of the Department of Scientific and Industrial Research.**—These now consist of the National Physical Laboratory, the Fuel Research Station, the Building Research Station, the Forest Products Research Laboratory, the Road Research Station, a group of stations under the Food Investigation Board, the Water Pollution Research Laboratory, etc.

The results of individual work for private firms are, of course, communicated in the form of a confidential report, and the full cost is paid by the firm. The results of the general program of work are made available in annual or special reports sold through H.M. Stationery Office. Firms, therefore, can benefit from all this work, as well as having access to the advisory and information services of the stations, usually without any payment.

3. **Research associations.**—These were started at the end of the last war with the help of a million pound fund voted by the Government to the Department of Scientific and Industrial Research. There are now twenty-four of them, and they are self-governing bodies, supported voluntarily by firms engaged in the industries for which they cater, or in a few cases by a levy on the raw materials of the industry in question. The Department of Scientific and Industrial Research supports the associations financially by means of annual grants to an amount depending on the subscriptions from industry. This year the total incomes of the associations will be over £800,000, of which £275,000 will be Government grant. The subscriptions vary with the size of the member firm, being in some cases as low as £10 annually for the smallest unit. Most of the associations possess their own laboratories, but some of their work is done in Government or university laboratories or in the laboratories of member firms. The control of the associations is in the hands of councils elected by the members; the results of the work are confidential to members but, in fact, much of it is subsequently published and added to the general fund of knowledge.

4. **Private industrial research laboratories.**—Although some of the work carried out is of a fundamental character, a proportion of it is necessarily of a more immediate and practical

character concerned with a firm's day-to-day problems.

Hardly any of the firms who possess research laboratories confine their expenditure on research to their own establishments. They are, as a rule, the strongest supporters of the research associations and make the most use of the results obtained in the D.S.I.R. stations and at university laboratories.

### The Place of Research in Industrial Firms

For large firms there should be little difficulty in establishing a research department of their own and in building and equipping the necessary laboratories. The first step is to decide on the problems which invite attack, the next to decide on the scale of the attack, to find suitable staff, and gradually to make research a recognised part of the organisation. This will take time, as a research staff have to learn their problems. Confidence will be established between them and their colleagues as they show their ability to help in the day-to-day difficulties, "trouble shooting" as the Americans call it. The long-range problems need patience and only a part of this work can be expected to bear fruit, but it is surprising how quickly research begins to give results, sometimes in quite unexpected directions. In time the whole concern will become research-minded, and in America it is not unusual to find the head of a research department with a seat on the board.

For smaller firms the starting of research is not so easy, and there are so many of them. In our five largest industries, for example, there are nearly 5,000 separate undertakings, of which only 126 employ more than 1,000 people each. It was for smaller firms that the Association movement was largely conceived, since by cooperative research an annual subscription of, say, £100, may ensure participation in the results of a research expenditure of £20,000 per annum or more.

However, the payment of such a subscription is only the beginning. It is essential, even in the smallest unit, that there should be at least one member of the staff with sufficient scientific training to follow the work carried out in the Research Association and interpret it to his firm. Such a man, too, can be of the greatest value in appraising the results and implications of other published research bearing on his firm's interests, and in general acting as a scientific adviser and consultant. Such men should be more common in our industries, and they should be accorded a status which will ensure their voices being heard. No firm should be deterred from taking up research merely because it cannot afford in the first instance an expensive laboratory and equipment. It is the quality of the man that counts.

### Research Men

Research is apt in many minds to conjure up a limited picture of a chemist in a laboratory, and whilst it is true that the chemist often forms the starting point around which a research team grows, industry now employs physicists, metallurgists, mathematicians, research engineers, biologists and geologists, as well as specialists in more restricted fields such as radiology, corrosion, statistics, etc. Information officers, with a knowledge of foreign languages, are also found in the larger research establishments, since it is so essential to keep abreast

of published scientific work at home and abroad.

The success of a research laboratory depends on the men with ideas. Only experience can show who they are. They may come in as university graduates, as assistants or as laboratory boys. Encouragement and a watchful eye are needed to find them.

### The Cost of Research

It is difficult to lay down any general standard of research expenditure. It has been stated that whereas the total U.S.S.R. budget for science is 1 percent of the national income, ours is but one-tenth of one percent, and that of the U. S. A. three-tenths. Taking expenditure by individual American trades we find the ratio of the research budget to gross sales is for radio apparatus 1.6 percent, for electrical communication 1.4 percent, and for chemical industry and rubber products 1 percent, but in the older industries the ratio is much less.

Whatever the scale on which research is begun, it is a general experience that its budget increases as it is found to be more and more indispensable.

The initial step of subscribing to a Research association is not costly. In many cases a small firm would be assessed for subscription at ten to twenty guineas, and not many of the larger units subscribe more than £1,000 per annum. In two typical research associations at the present time the average subscription of members is only about fifty pounds. For this outlay, the subscribing member participates in research costing 500 times this figure. However, subscriptions to research associations must in future be larger in order to give them more adequate resources.

### How Research Pays a Dividend

That research not only pays but is of vital importance to our national existence is clear in war-time.

What research has meant in peace-time can be seen from the savings that have come from a few inventions. It is estimated that the gas-filled lamp developed by Langmuir represents an annual saving in the cost of domestic lighting in this country alone £50,000,000. The improvement in the efficiency of the petrol engine due to lead ethyl saves over 2,000,000,000 gallons of petrol a year. The use of accelerators for vulcanizing rubber has saved capital outlay on moulds estimated at £16,000,000. Research on motor tires has increased their average life from 3,000 miles to over 20,000 miles.

Naturally, these vast savings have been reflected in the profits and prosperity of the industries and firms responsible for these great technical advances.

The first question any firm will ask is, what return can we expect from expenditure on research? The answer is partly given above, for there will always be brilliant prizes to be won. But the short answer is that no firm can afford to neglect research, as it is the only safeguard of the future. The time may come when the public will look at the research expenditure as an index of a firm's prospects; if those figures were all available today they might reveal the secret of many failures and success.

When we are ill we send for a doctor. He can delay, but he cannot prevent old age. Research is the elixir of life of industry, ever renewing its youth and vigour.

**Response to Article in *Textile Research* Indicates Wide-spread Interest in the Position of**

# The Textile Technologist

**By DOUGLAS G. WOOLF**

The reaction to my article on "The Executive and the Technologist" in the February issue of TEXTILE RESEARCH was surprising even to me, an admitted bug on the subject. Comments by mail, over the 'phone, and in personal conversation, indicate that a lot of other people share my belief that the relationship between the executive and the technologist merits exploratory thought. A few samples of these comments appear below.

The basic fact which this reaction reveals, or rather confirms, is the need for a greater awareness of the personnel problem in, let us say, the higher brackets. By now, no textile manufacturer doubts the existence of an employer-employee relationship problem. But, complex as that may seem to be, the subject I am discussing here is infinitely more so. It involves men and women who cannot, or should not, be placed in the employee pigeon-hole. In fact they can't be placed in any pigeon-hole at all. They defy classification—and rightly so.

The men and women we are discussing are the key personnel of the textile industry of the future. In their hands, more than in the hands of the treasurer or the finance committee, rests the future prospect of the individual textile company. But they themselves know that, only through an integration of their efforts with those of *all* the executives of the company, can their future and that of the company be made reasonably secure.

The situation is further complicated by the fact that other industries are in the market for textile technologists. And that type of competition is potentially more disastrous than the inroads of other industries on textile markets.

The war has created a time-lag in the development of technically-trained men and women, in all industries. The bidding for those available in the post-war period will be sharp. If it were just a question of dollars-and-cents in salaries, the textile industry would be outbid before it started to bid.

But there is an intangible factor which must be recognized. Most of the technologists whom we know in the textile industry would like to remain in that industry. Call it loyalty, if you like, or reluctance to change, if you like. The fact is that a technical man is not merely a technical man; he is a textile man, or a steel man, or what have you. He identifies himself with the industry which gave him his start.

So, that brings us down to brass tacks. If the textile industry wants a technical staff commensurate with its needs, it will not try to keep its present personnel by pulling out the loyalty plug on its organ. It will, first, make the jobs of those men and women

secure and progressive. It will, second, make its own economy attractive to technically-trained men and women, wherever they are.

A start has been made. Three Foundations in the South have started to elevate the level of basic textile training in textile schools. Other schools in the East and North are blazing a similar trail. Much of this has stemmed from the education program of the Textile Foundation, under the direction of Fred Feiker.

But there is a further trail. The Textile-Research Institute has in making a graduate-training program which will develop men and women at the graduate level.

This is all to the good.

But the basic requirement still exists: making the textile industry a good place in which to work. That is where the economic research program of the Textile Research Institute comes in.

More about that in a later chapter of this serial story.

## Reactions from Readers

"**I am distributing reprints** of your article "The Executive and Technologist" from the February issue of TEXTILE RESEARCH to the entire membership of the American Association of Textile Technologists. As you remember, when I called you after reading it, I was extremely enthusiastic. I believe that more of this should be fostered in the entire industry as we are, both Executive and Technologist, a definite part in the functioning of textiles."—CARL C. MATTMANN, JR., chairman, Program and Publicity, American Association of Textile Technologists.

"**Mr. Carl C. Mattmann, Jr.,** forwarded me a brochure entitled 'Executive and Technologist' prepared by you and included in the February issue of 'Textile Technologist.'

"I have read your brief article with a great deal of interest and I think it is well timed. I find myself in hearty agreement with you that in our present day more financially minded technologists are needed to support the executives or principal key men in our various textile plants, not only to help them to resolve their problems but to train them individually and collectively to become more research minded.

"We need more brief, pungent, understandable articles like yours in our various industrial publications."—N. M. MITCHELL, president, Barnes Textile Associates, Inc.

"**Your article** on 'Executive and Technologist' which appeared in the February issue of TEXTILE RESEARCH, has just reached me through the Publicity Chairman of the American Association of Textile Technologists, and I must say I read and inwardly digested every word of this little brochure, and am sure I am expressing the opinion of every member of our Association when I say it is a fine contribution to the standards of the textile industry, and I only hope it gets into the hands of every executive in this field, as closer cooperation between him and the technologists is, I believe, imperative to the progress of the industry as a whole, especially in the post-war era which is now looming more brightly each month.

"As a technologist, I wish to extend my appreciation of this literary accomplishment, which so thoughtfully and widely embraces the ills which we have had to bear.

"We hope to hear from you again, Mr. Woolf."—WM. F. GOEDECKE, Montreal, Que., Canada.

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"**Once again** may I be numbered among the many who I know will write you concerning the editorial published in the February issue of the TEXTILE RESEARCH under the title of Executive and Technologist.

"Your insight and knowledge in this particular field is outstanding. Seeing both sides of the story as you do, should furnish real food for thought for both the technologist and the executive.

"Such a contribution to the textile industry especially now is most timely. Please accept my congratulations for a job more than well done."—WILLIAM D. FALES, head, Textile School, Rhode Island School of Design.

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"**Your recent article** 'The Post-War Era Demands Close Cooperation Between Executive and Technologist' in TEXTILE RESEARCH certainly brings to the fore the need for technical progress achieved through systematic research in the textile industry. That a new, higher evaluation of the financial benefits derived from an active research program will also bring about an improvement in the status of the technologist is not to be doubted, but it is likely that such improvement will not be an over-night development. The majority of the executives are successful promoters, able to promote not only their companies' wares but also themselves, with corresponding financial success to their companies and themselves. How many good technologists have this ability?

"New business ventures are undertaken solely by the prospects of profits, and your amusing reference to the 'side-show' in raw-material speculation illuminates one phase of textile manufacturing which has been all but eliminated by a number of concerns processing synthetic fibers. The reason that these concerns have in many instances prospered to a greater extent than those processing exclusively wool or cotton with their added 'speculation feature' can safely be attributed to systematic research. And who has undertaken this research up to the present time? The big rayon producers and chemical manufacturers—grown big by reason of their research—have done practically all of it, and judging by past performance, it will be next to impossible to sell in lean times the idea of research to the hard-pressed textile manufacturing executive, offering financial returns only at some uncertain future date. In addition, what could be simpler and less expensive than to continue to rely on the rayon producers and the chemical houses for technological assistance, as in the past?

"It would be my sentiment that the technologist needs, in the worst way, some promotion program of his own, say some series of concrete examples, developments made in the past which have 'paid off,' in order to focus the general attention of executives on the subject. Comparatively inarticulate, and rather unskilled in the art of promotion, the technologist may thus

smoothen the path of his millennium and enlist these self-same executives to champion his cause, for a mutual salvation.

"With best wishes for success in your endeavors, I am,"—WM. O. HOLMES, Forest Hills, N. Y.

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**"I received** within the past week or so a small pamphlet entitled 'Executive and Technologist' which was reprinted from your TEXTILE RESEARCH bulletin of February 1944.

"Would it be possible for you to forward to me for distribution in our company about twelve copies of this short article?

"Thanking you very much for your prompt attention in this matter, I am,"—EDMUND L. LAUBER, Textile Research Department, American Viscose Corporation.

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**"I have just had the pleasure** of receiving your article 'Executive and Technologist' through the American Association of Textile Technologists. I want to hasten to say that I believe it is the most concise bit of fact I have had the pleasure of reading relative to a matter that is so interwoven in textiles, that it has, in the past, been astounding to me to note the short-sightedness of the man or men at the helm in steering the industrial ship on what has always appeared to me to be an unchartered sea, without a textile compass.

"I do hope that your article is well circulated throughout the textile industry of these United States, for there still appears to be a degree of skepticism and a leaning in some directions toward a fallacious desire to consider the research laboratory a glamorized adjunct to business, and those occupied in this direction as being somewhat removed from a coordinated setup.

"Will you be kind enough to see that I get a dozen of these reprints. I know of some places where I would like to place them on the executive desk."—T. B. HAYWARD, Member, Board of Governors, Philadelphia Textile Institute.

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**"I want to extend** my congratulations for your stimulating and forthright editorial on 'The Post-War Era Demands Close Cooperation Between Executive and Technologist' and to express the wish that the subject be further explored and commented upon.

"What is bothering most technologists is what they should do about it. Articles such as you have written which serve to promote thinking and discussion are without doubt the first step and a most helpful one. Both industry and technician will benefit from any improvement. Recognition of what the technical staff contributes towards the success or failure of the business, and of a larger and more prominent part by the technologist in the forming of policies and plans as well as in carrying them through to a successful completion, will pay big dividends to the concern as well as to the individual....

"You have adequately described the existing conditions and I believe there is a great service in this connection which can be rendered to the textile industry and to the scientists and technologists serving this industry. Is the status of the technologist that of the professional man—the engineer and the architect—or is it that of the craftsman—the operator of the engine or the builder of the structure which the professional man designs?"—JOHN F. HAGEN, Callaway Mills, New York.

# RESEARCH ACTIVITIES

**The Textile Foundation,** at the annual meeting of its Board of Directors April 19, authorized a study in the field of textile economics aimed to throw light on the probable competitive position of the American textile industry in the post-war era. Textile Research Institute, Inc., will be asked to administer the study and to select appropriate agencies or individuals to collect it. The findings will be presented from time to time to the textile industry in a form which should be useful to companies in formulating their operating policies.

At the same meeting, there was discussion of a report on textile education and of the part textile schools can play in the veterans' rehabilitation program. For some time, the National Council of Textile School Deans has been working in cooperation with administrative officers of the Veterans' Bureau and of the U. S. Office of Education to develop a plan under which qualified veterans of the Armed Services would be trained for useful technical and management positions in the textile industry.

Other reports received and discussed were the Foundation's research work in Washington, all of which is now devoted to projects having to do with the prosecution of the war; and the cooperation between the Foundation and the Textile Research Institute, Inc.

Members of the board are Franklin W. Hobbs, of Boston; Frank D. Cheney, of Manchester, Conn.; Donald Comer, of Birmingham, Ala.; Jesse H. Jones, Secretary of Commerce, and Claude R. Wickard, Secretary of Agriculture. Mr. Hobbs was unanimously re-elected chairman of the board for the 15th consecutive time. Mr. Cheney continues as treasurer, and Edward T. Pickard as secretary and assistant treasurer.

**Harry Riemer,** who has been for 27 years dry goods editor for the *Daily News Record* has been appointed to the post of editor of that newspaper. The post of editor is a new one and Mr. Riemer's appointment will permit further development not only of the dry goods sections, but also of all present divisions of the publishing property. It is planned to add new sections to the paper after the war.

**A series of theory-practice seminars** has been inaugurated by Fabric Research Laboratories, Inc., Boston, Mass., for the purpose of advancing the skill and knowledge of its staff members in the field of textile research. The meetings, to be held weekly, will cover all phases of textile research and technology and will be devoted to advanced techniques and methods as related to physical, chemical and microscopic phases of textile research. Emphasis will be placed on the theoretical aspects of the many tests involved as well as the application of the theory to laboratory procedures.

**"What, How, Why in Textile Research"** was the subject of a lecture delivered at the first of the theory practice seminars at Fabric Research Laboratories, Inc., by Edward F. Schwarz, F.T.I., professor in charge of the Tex-

tile Division of M.I.T. "Unbiased judgment is essential for the textile technologists," stated Professor Schwarz. "The task is not to seek by any and every means to prove a preconceived idea to be true, but rather to determine by the facts what they show of and for themselves. Textile Research (or any research) may be said to be the collection, arrangement, classification, analysis and simplification of data leading to a working hypothesis, which under test may become an established theory to explain the working of a law."

**Built-in-water-resistance** as an inherent quality for synthetic fibers to give properties now imparted as textile finishes were forecast by Dr. Gordon M. Kline, of the National Bureau of Standards, speaking before the recent Cleveland convention of the American Chemical Society. Dr. Kline stated that it was reasonable to expect to find that "New combinations of properties never attainable in wool, silk, and cotton have been built into the synthetic resins from which these new fibers are manufactured.

**Sensational improvements** in textile machinery which will not, however, become available until some time after the war were predicted by N. M. Mitchell, president and manager of Barnes Textile Associates, speaking before the April meeting of the American Association of Textile Technologists in New York. The major types and classifications of textile machinery being considered, as reported by Mr. Mitchell, cover the range from opening equipment to that used in finishing. Mr. Mitchell outlined many improvements that have been developed by various manufacturers and emphasized that many developments embracing new materials such as magnesium alloys, plastics and new types of steel and employing new principles, such as electronics, will require a tremendous amount of engineering research before the tested practicability of their use can be determined to a degree that will permit their use in a commercial way.

**Special fabric coating** compounds from a new series of elastomers created by B. F. Goodrich Co. are reported by that company. These compounds are mixtures of vinyl resins and oil resistant synthetic rubber, and compositions made from these blends can be extruded, molded, calendered, or spread, according to the report.

**The summer course** in textiles and testing held in the main laboratories of U. S. Testing Co., Hoboken, N. J., will commence July 10 and extend through July 28. The course will cover current textile theory and testing procedures, and will also review the testing of other commodities.

**Sub-Committee B–4** on bleaching, dyeing and finishing, of Committee D–13 of the American Society for Testing Materials has been broken down into nine sections to facilitate progress on its various research projects. The sections and section chairmen are as follows: (1) Accelerated Ageing Tests for Cotton, Kenneth H. Barnard, Pacific Mills, chairman. (2) Resistance of Textiles to Insect Pests, Herman E. Wilde, Merck & Co., chairman. (3) Resistance of Textiles to Micro Organisms, Dr. O. B. Hager, Rohm & Haas, chairman. (4) Identi-

fication of Textile Finishes, F. P. Brennan, U. S. Testing Co., chairman. (5) Water Resistance to Textile Fabrics, G. A. Slowinske, E. I. du Pont de Nemours & Co., chairman. (6) Fastness to Washing and Laundering, Charles W. Dorn, J. C. Penney Co., chairman. (7) Resistance to Fire. (8) Determination of Copper Content. (9) Light Fastness.

**A recent article** by Dr. Earle N. Bressman, Director of Inter American Institute of Agricultural Sciences, reports progress in the growth of abaca, better known as Manilla hemp, in Central America. In Costa Rica 12,000 acres have been planted with a program calling for planting of 40,000 acres which it is assumed will produce from 50 to 60 million pounds of fiber annually, approximately half the pre-war demand of the U. S. It is said that disease-resistant varieties have been developed and that in Central America they produce two to three times as much as is normally produced in the Philippines.

**Bernice S. Bronner,** formerly of Good Housekeeping Institute, has joined the staff of the American Standards Association, succeeding Morris L. Chandross, who is on leave with the office of Civilian Requirements of WPB. Miss Bronner will be textile technologist at A.S.A.

**Abstracts of enemy owned U. S. patents** seized by the Alien Property Custodian, to the number of 7,000, have been compiled and printed copies are now available. The compilation is in 33 sections and includes fats, oils, soaps, waxes; plastics, synthetic resins, plastiques, solvents; elastomers; textiles, natural and synthetic fibers; dyes, dyeing processes, and textile chemicals. The abstracts may be had at $1.00 per section or $25 for the complete set from the office of Alien Property Custodian, Chicago 3, Illinois.

**The annual convention** of the American Association of Textile Chemists and Colorists is planned for October 12–14, to be held at Hotel Claridge in Atlantic City.

**A British patent** has been applied for by Martin Wadell, of Belfast, North Ireland, for a new and simplified method of bleaching textiles employing liquid oxygen. The liquid is forced into a container filled to capacity with the material to be bleached. When the required shade of white is attained, the liquid is allowed to escape as gas into another container and then recompressed to be used again. It is said that the process can also be used to eliminate the retting process for flax.

*Correction*—in TEXTILE RESEARCH for March, page 74, appeared an item in regard to the establishment of the Munsell Color Foundation. Creation of the Munsell Color Foundation does not alter the status of the Munsell Color Company which will continue the services it has heretofore rendered. The Foundation has received as a gift from Juliet E. Orr Munsell on behalf of her son A. E. O. Munsell the stock of the company, but the Foundation itself is exclusively an organization for scientific and educational purposes.

**Clemson Conference Takes Final Steps to Establish the**

# Industrial Fiber Society

As the direct outgrowth of an idea conceived by a group of scientific men who met at Atlanta, Georgia, several years ago, has come the decision to establish as a permanent organization the Industrial Fiber Society. The final steps to provide a permanent organization for the group were taken at the third and most recent meeting which has just been held at Clemson College, Clemson, South Carolina. Those attending the conferences have unanimously agreed that they have been so worth-while that the necessary organization and mechanism to assure continuance of these meetings should be established. The organizing committee accepted, except for editorial revision, a constitution and by-laws which will establish the Industrial Fiber Society as a permanent organization by the time of its next meeting in the fall.

The purposes of the Society are perhaps best illustrated by quoting directly from the new constitution, Article I, Section II as follows:

"The Society is conceived on the hypothesis that the benefits of scientific knowledge gained through research on fibrous materials accrue to industry best, and this knowledge develops and matures most soundly, only when there can be a meeting of minds, resulting in a free exchange of ideas and scientific facts. This Society is hereby established to provide the necessary means to this end, to encourage the informal presentation of papers on work both completed and in progress, and to stimulate helpful discussions on a high scientific level."

It is further required by the by-laws that no quotation or statement of opinion made during the discussions may go to press. It is furthermore provided that in order to fulfill the objectives of the Society and at the same time benefit the greatest number of people membership shall be limited if such action becomes necessary.

It is significant that the scope of this Society's interests is fibrous materials in general, their physical and chemical properties, their origin and manufacture and the technological applications to industry. It is a scientific society to provide means for the much needed informal get togethers between scientific people of various professions and specialties within the field of research on fibrous materials. It is also worthy of note that although the greater bulk of industries employing what one customarily thinks of as fibrous materials is classed as "textile," this society does not have this limitation. In a more general sense the scope of the Society's interest may be thought of as including all high polymeric substances in so far as these materials are used in industry in a fibrous form.

The organizing committee consists of J. P. Elting, Chairman; W. R. Marsden, Treasurer; John T. Wigington, Secretary; Carl M. Conrad, G. A. Rosselot, R. W. Vose, and Malcolm Campbell.

Further information regarding the Society may be had by writing John T. Wigington, Secretary, Box 151, Clemson, S. C.

# RESEARCH AIDS

## 25 Years of Worth Street

The Association of Cotton Textile Merchants of New York has printed privately a limited edition of a book entitled "25 Years: The Association of Cotton Textile Merchants of New York, 1918–43." It is not only a stirring record of a quarter century, but it is full of valuable reference information. Included in the latter is a composite chart of the association's statistical compilation of "Ten Years of Cotton Textiles." This composite chart runs from 1922 to 1943. The book was prepared by W. Ray Bell, president.

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## A.S.T.M. Standards

Supplement to Part III on Nonmetallic Materials, published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., contains the newly adopted and revised standards and the new and revised tentative standards in the nonmetallic general materials field that have been accepted since the appearance of the 1942 Book of Standards, Part III. The standards appearing in this supplement are indexed in the current Index to A.S.T.M. Standards which is published separately.

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## Forward with Science*

Modern developments in physical science are outlined in "Forward with Science" by Rogers D. Rush, author of "Atoms, Men and Stars." Dr. Rush who is now professor and chairman of the Department of Physics at Mount Holyoke College intended this book to be intelligible to the layman. It will also be found of interest to the technologist who desires to be up-to-date in his knowledge of the revolution going on in science. Latest discoveries in the field of subatomic particles, atom smashing and splitting of the uranium atom, man-made radioactivity, and cosmic rays are described. The author has also analyzed the significance of these discoveries for human beings, their application in war, and their potentialities for the future peace. The book will be found to be not only informative but it is provocative of thought.

* FORWARD WITH SCIENCE. Rogers D. Rush. *Alfred A. Knopf, 501 Madison Avenue, New York, N. Y. 307 pp. Price $3.50.*

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## Infrared Spectroscopy*

The theory of infrared absorption and its relation to molecular structure are discussed to provide the essential background for detailed descriptions of techniques useful in analysis.

The applications and the results discussed are based entirely on work done in the Stamford Research Laboratories of the American Cyanamid Company in order that a unified picture of a typical, infrared research program could be available to those who may be interested.

A library of 363 representative spectra of organic compounds taken in the rock salt region of the infrared spectrum is presented for comparison with those obtained from unknown compounds under investigation. A bibliography of 2701 items is included.

* INFARED SPECTROSCOPY. R. Bowling Barnes, Urner Liddel, and Van Zandt Williams. *Reinhold Publishing Corp., 330 West 42nd St., New York, N. Y. 236 pp. Price $2.25.*

**Principal Factors Contributing to "Clammy Feel" Are Evaluated by Recent Research on the**

# Thermal Properties of Moist Fabrics

**By CHARLES W. HOCK, ARNOLD W. SOOKNE, AND MILTON HARRIS**[1]

*The following article is a condensed report of studies conducted by research associates of the Textile Foundation, working at the National Bureau of Standards, Washington, D. C. The complete report appears in the current (May) issue of Journal of Research published by the Bureau.*

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**Abstract**

The "chilling effect" or "clamminess," which moist fabrics produce when in contact with the body, was evaluated by subjective tests, by measurement of the drop in temperature which ensues when the moist fabrics are placed on an artificial "skin" surface, and by tests with a moisture-sensitive paper designed to measure the extent of contact which the fabrics made with a surface. Using fabrics of various fiber compositions and constructions a good qualitative relation was found in these tests. Fabrics which produced considerable chilling in subjective tests were found to make good contact, and to cause a substantial drop in skin temperature. Conversely, fabrics which caused little or no clamminess made poor contact, and the accompanying drop in temperature was relatively small. The results of these experiments show clearly the progressive improvement of the fabrics with respect to chilling, as their wool content is increased, and also the superiority of certain types of construction which minimize the extent of contact of the fabrics with the skin.

## Introduction

Practical experience has demonstrated that moist fabrics in contact with the body produce an unpleasant sensation commonly referred to as a "chilling effect" or a "clammy feel." The degree of the sensation varies with different fibers and fabrics; thus, on the basis of general experience, the merits of wool fabrics over similar cotton fabrics have long been recognized. This is one of the reasons, for example, for the preference usually given to woolen underwear and other garments for use in cold climates under conditions where physical labor causes considerable perspiration. It also accounts for the approval commonly expressed for woolen bathing suits.

In selecting fabrics for warmth, the thermal resistance is a factor of primary importance, and this property has been measured by many investigators. In general, the results indicate that for comparable thicknesses and densities there are no outstanding differences between different fabrics. The chilling effect noted above, however, has sug-

[1] Research Associates at the National Bureau of Standards, representing the Textile Foundation.

Table I—Description of fabrics

| Code | Type of spinning | Type of knitting | Fiber content of Yarn | Nominal Wt. of undershirts, 1 doz., Size 40 (unlaundered) |
|---|---|---|---|---|
| A | Cotton | Rib | 100% cotton | 10½ lbs. |
| B | Cotton | Rib | 75% cotton—25% wool | 10½ |
| C | French | Rib | 50% cotton—50% wool | 10½ |
| D | French | Rib | 50% cotton—50% wool | 10½ |
| E | French | Rib | 25% cotton—75% wool | 10½ |
| F | French | Rib | 100% wool | 10½ |
| M | Cotton | Rib | 100% cotton | 5½ to 6 |
| N | Cotton | Rib | 75% cotton—25% wool | 5½ to 6 |
| O | French | Rib | 50% cotton—50% wool | 5½ to 6 |
| Q | French | Rib | 25% cotton—75% wool | 5½ to 6 |
| R | French | Rib | 100% wool | 5½ to 6 |
| XB | Cotton & French | Duofold type | 100% cotton in—100% wool out | 10½ |
| XC | Cotton & French | Duofold type | 100% cotton out—100% wool in | 10½ |

gested that marked differences may be obtained as the amount of moisture contained in a fabric is appreciably increased, and accordingly an investigation was undertaken to evaluate this and other factors contributing to the phenomena of chilliness or clamminess in wet fabrics.

## Materials

Thirty-six samples of knit underwear fabric, prepared especially for experimental purposes, were used throughout the investigation. The fabrics consisted of plain and special knits of various weights and thicknesses and of different fiber compositions, some of which are described in Table I. Both unlaundered and twice laundered samples were examined.

## Experimental Procedure

1. **Subjective tests.**—These tests were carried out in a room conditioned at 21.1° C. and 65 percent relative humidity. Three and one-half inch squares of the fabrics were tested when containing 100, 150, and 200 percent moisture, based on their conditioned weights. They were tested two at a time, on five male subjects, by simultaneously placing one fabric on the right and the other on the left arm (radial ulnar region of the forearm). The subject was then asked whether he detected a difference in chilling effect between the two arms, and if so, which fabric gave the greater sensation of chilling. Each fabric was left on the arm for 15 sec. and then removed, because it was found that the subject's immediate reaction appeared to be most reliable. Although some persons were able to perceive slight differences better than others, the subjective reactions of various individuals were in very good agreement.

2. **Measurement of drop in surface temperature.**—Measurement of drop in surface temperature was obtained by placing the moist fabrics on an artificial "skin" surface. The apparatus [2] was arranged to provide condi-

[2] Detailed description of the apparatus and procedure followed is given in the May issue of *Journal of Research.*

tions under which a substantial drop in "skin" temperature could be measured.

3. "**Contact tests.**"—Since it is reasonable to expect that the chilling effect of wet fabrics may be related to the extent of contact which they make with the skin, a method was devised to check this hypothesis. A moisture-sensitive paper was prepared by impregnating a soft paper with a water-soluble dye of high tinctorial power.[3] A piece of sensitized paper was first laid on a dry glass surface. The wet fabric was then placed on top of the paper, and covered with a glass square of similar size, and weights to bring the pressure to 0.5 lb. per square inch. After 10 minutes the fabrics and weights were removed. The papers, which were practically colorless originally, became red where the moist fabrics touched them, thereby indicating the extent of contact of the fabrics.[4] Photometric measurements of the reflectance of the papers were subsequently made, thus making it possible to assign to each fabric a numerical value indicative of its contact at any given moisture content. The measurements were made by means of a Martens photometer, using a filter isolating the 560 millimicron line.

## Results and Discussion

1. **Qualitative relation between subjective and objective tests.**—This investigation was undertaken not to develop a standard technique for evaluating the chilling properties of fabrics, but rather to develop a method for studying a phenomenon which has been observed empirically for a long time. Owing to the many complex factors which contribute to this phenomenon, an attempt will not be made to present the data on a qualitative basis. It is recognized, furthermore, that only one aspect of the larger problem of the thermal properties of fabrics has been studied. Nevertheless, several significant relationships were noted, and these will be discussed in more or less general terms, making no effort to account for small differences between the many and diverse fabrics included in the investigation.

**Table II—Subjective results obtained with fabrics containing 200 percent moisture on the basis of their conditioned weights**

| Samples compared | Subjective reaction |
|---|---|
| A and F | A much colder |
| M and O | M much colder |
| N and R | Neither produces much chill, but N slightly colder |
| XB and XC | XB cold, XC warm feel |

The results of the subjective tests were in very good agreement with the direct measurements of drop in temperature, and degree of contact. The results of a typical set of subjective experiments are given in Table II, and may be compared with the corresponding objective measurements of Figs. 1 to 5. When, as for example with sample A, the subject experienced pronounced chilling, a substantial drop in temperature was measured, and the fabric was found to make good contact with the skin. On the other hand, a smaller drop in temperature was measured, and poor contact was observed in fabrics such as sample F, which did not

[3] Description of the method used in the preparation of the test papers is given in the May *Journal of Research.*

[4] This test does not actually measure the contact which the fabrics make with the human skin, but for the purposes of the present investigation, the test is believed to be an adequate indirect measure of this property.

produce a sensation of chilling to the subject. This correlation between subjective reaction and contact was especially interesting when the fabrics were placed on the moisture-sensitive papers, immediately after their removal from the arm. Invariably, when the subjects experienced pronounced differences in comfort, similar outstanding differences in contact were observed. Likewise, when the individuals perceived little or no difference in chilling effect, the sensitized papers showed that the two fabrics made similar contact. A typical series of contact papers, obtained when the fabrics contained 200 percent moisture, is shown in Fig. 1. It is clear that, although all the fabrics contained equal percentages of water, some made much more contact with the papers than others. Thus, for example, samples A and M made very good contact, whereas others such as F, R, and XC made poor contact. This variation in contact is shown graphically in Figs. 2 and 3 where the reflectance of the papers as measured photometrically, is plotted against percent of moisture in the fabrics.

2. **Influence of fiber content on chilling effect.**—Figs. 4 and 5 show the drop in temperature caused by laundered fabrics of comparable weight and construction, but of different fiber compositions. The curves show a rapid initial drop in surface temperature [5] during the first 30 sec. of the measurements, usually followed by a slight increase in temperature, after which an approximately steady state is reached.

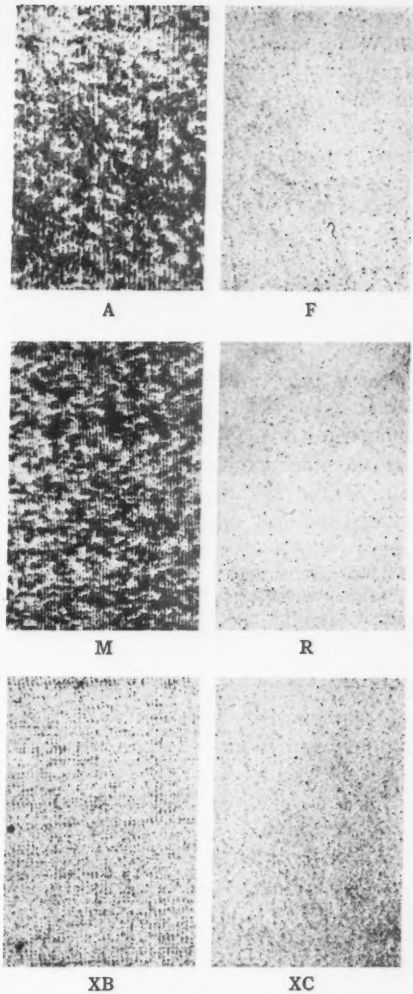



**Fig. 1. Photograph of "contact" papers obtained with fabrics containing 200 percent moisture.**

Since the thermocouple readings are influenced by the underside of the moist fabric as well as by the "skin" the readings do not correspond precisely to the "skin" temperatures.

[5] In the course of the measurements on the transmission of heat through textile fabrics, Rees observed a very small drop in temperature when fabrics conditioned at 25° C. and 65 percent relative humidity were brought in contact with a hot plate. The magnitude of the drop was greater for cotton than for woolen fabrics.

This fact probably accounts in large measure for the unusual shape of the curves in the early portion of the measurements. Thus, the rapid initial drop in temperature caused by the contact of the moist sample is followed by a rise in temperature, corresponding to an interval in which the heat supplied exceeds the heat lost by evaporation. When the loss of heat by evaporation becomes sufficiently great, a decrease in the thermocouple temperature again ensues. The heavier fabrics, because of their higher heat capacity and greater (absolute) content of water, cause a larger initial drop in "skin" temperature (compare Figs. 4 and 5). On the other hand, a longer time is required for the evaporative losses to exceed the heat supplied in the case of the heavier samples.

In general the results of Fig. 4 show a regular, progressive decrease in chilling effect of 10½ lb fabrics with increase in their wool content. Similar results were obtained for samples of nominal weights of 8 to 8¼ lbs; also for 5½ to 6 lbs (shown in Fig. 5). Sample R (Fig. 5), which showed the smallest decrease in temperature of all the rib knit samples, was characterized by a very fuzzy surface after laundering and was considerably thicker than other fabrics of comparable weight. Comparison of the curves showing drop in surface temperature (Figs. 4 and 5) with those showing reflectance[6] of

[6] The more color produced on the papers as a result of contact with the wet fabrics, the lower is their reflectance.

**Fig. 2. Reflectance of "contact" papers obtained with fabrics containing various percentages of moisture. 10½ lb fabrics composed of various percentages of cotton and wool.**

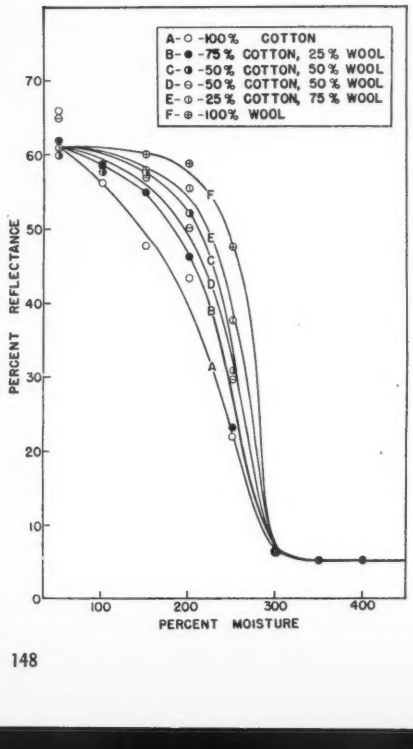
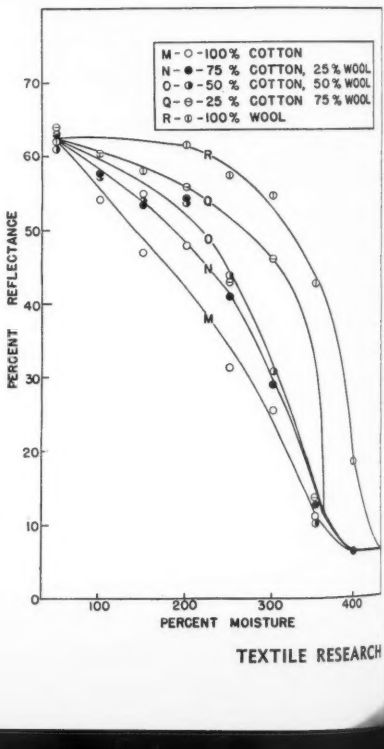



**Fig. 3. Reflectance of "contact" papers obtained with fabrics containing various percentages of moisture. 5½ to 6 lb fabrics composed of various percentages of cotton and wool.**



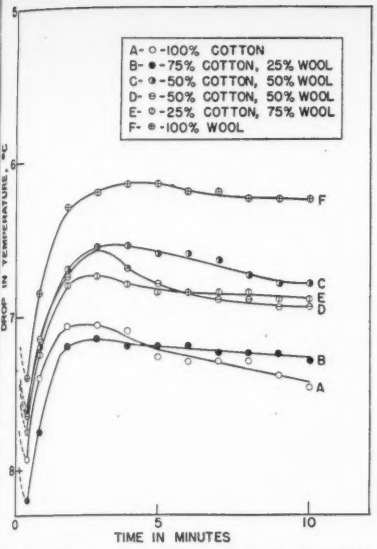



Fig. 4. Drop in temperature upon application of moist fabrics to heated "skin" surface. 10½ lb fabrics composed of various percentages of cotton and wool.

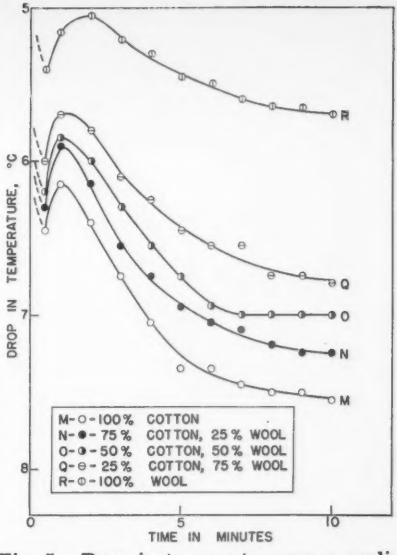



Fig. 5. Drop in temperature upon application of moist fabrics to heated "skin" surface. 5½ to 6 lb. fabrics composed of various percentages of cotton and wool.

the contact papers (Figs. 2 and 3) reveal a good qualitative relation between these two sets of measurements.

## Conclusion

Although it is difficult to rate on an absolute basis the "chilling effect" produced by the diverse fabrics which were included in these tests, several important conclusions can nevertheless be drawn. Thus, a progressive improvement of the fabrics as their wool content is increased and the superiority of certain types of construction are clearly indicated. The extent of contact which the fabrics make with the skin appears to be the significant factor, tests showing that those fabrics which make the poorest contact cause the least chilling. From this point of view, the desirability of wool fibers which are highly crimped and possess long range elasticity, properties which permit a type of fabric construction which minimizes the extent of contact which can be made with the skin, is apparent. In contrast, cotton which exhibits considerable plasticity when wet is less desirable from the same point of view. However, the results show that special types of construction, especially those which produce a napped or fuzzy surface reduce appreciably the contact which even wet cotton fabrics make and thereby lessen the chilling effect. It appears, therefore, that in selecting fabrics for warmth, especially when these fabrics are to be worn next to the skin in cold climates under conditions where considerable perspiration is produced, consideration should be given to the type of contact which they make with the body.[7]

[7] It is suggested that the type of contact may also be a factor in selecting fabrics for garments to be worn in hot climates, where keeping the body cool is a primary consideration. Preliminary evidence is available which indicates that for hot, humid regions, thin flat fabrics are highly desirable.

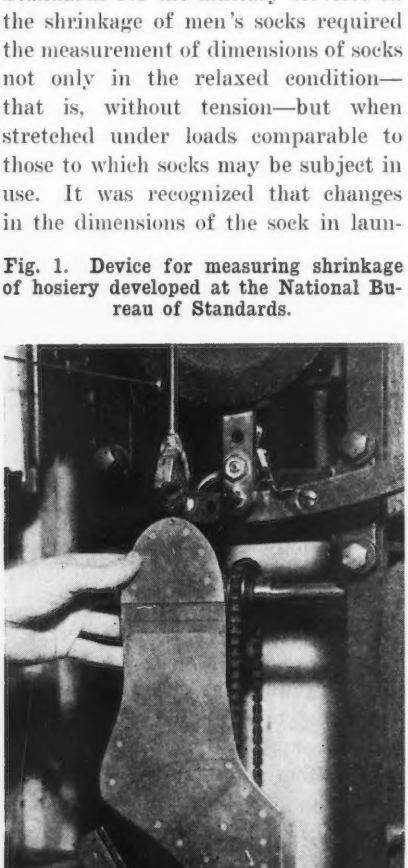
**Research for the Military Services Has Necessitated Development of a**

# Device for Measuring Shrinkage of Hosiery

**A report by Textile Section, National Bureau of Standards**

Recent work at the National Bureau of Standards for the military services on the shrinkage of men's socks required the measurement of dimensions of socks not only in the relaxed condition—that is, without tension—but when stretched under loads comparable to those to which socks may be subject in use. It was recognized that changes in the dimensions of the sock in laundering are not important if the sock readily accommodates itself to the size of the foot of the wearer and does not bind or become baggy. But if the sock shrinks and felts in laundering and fits too snugly, or if it becomes too loose-fitting, it is uncomfortable, wears at an excessive rate, and is discarded.

**Fig. 1. Device for measuring shrinkage of hosiery developed at the National Bureau of Standards.**



Accordingly, a new device for measuring the dimensions of the feet of socks and other hosiery under different loads was developed in the Textile Section of the Bureau (see Fig. 1). It has proved to be of value in the study of shrink-proofing treatments and effects of fiber composition and methods of laundering on the shrinkage of socks. The Quartermaster Corps is having a number of the devices built for its use.

The device is a flat metal form having the shape of a boarded sock. It is made in two parts. One part includes the region of the toe and has a flat extension the full width of the foot which slips between the faces of the second part of the form. Thus it is possible to draw out the foot of the form to fill socks of different sizes, for the width of the foot of flattened socks is the same for different sizes. The second part of the form, which includes the rest of the foot, heel and ankle, is provided with means for attaching it to the pulling member of a tensile testing machine and with a clamp for holding a sock on the form.

In carrying out a test the sock is placed on the form and clamped at a fixed position across the ankle. Another clamp is attached to the toe by means of a pin which passes through the sock and through a hole in the form near the toe. This clamp is attached to the weighing mechanism of the tensile machine. (Illustrated in Fig. 2.) The length of the sock at different loads without reduction in width is obtained from the stress-strain record of the machine. By testing socks before and after laundering, changes in dimensions at stated loads may be evaluated. Similarly, socks may be loaded and unloaded repeatedly, and the accompanying changes in dimensions at stated loads may be measured.

The device may be used without the tensile testing machine by attaching one end to a rigid support and adding weights to the other while it is hanging freely, and measuring the length of the sock on it.

Changes in width of foot or of welt are measured with equipment previously developed at the Bureau (N.B.S. Circular 422 "Methods of Testing Hosiery," page 15).

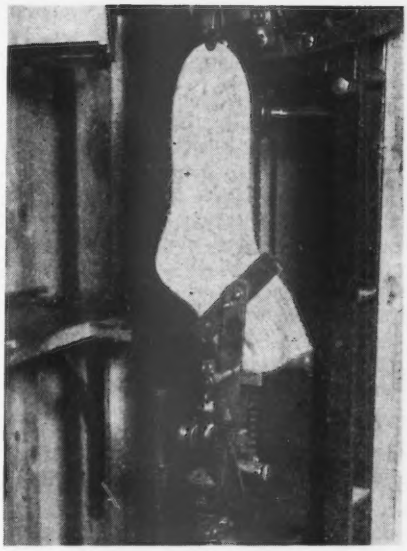


**Fig. 2. Sock under test at National Bureau of Standards using new device for measuring shrinkage.**

## New Name for Grex

*The following letter invites suggestions for possibly a better name for the proposed universal yarn numbering system which has been under consideration by Committee D–13 of the American Society for Testing Materials. The "Grex" unit is defined as grams per 10,000 meters. The proposed system was outlined in the January and February issues of* TEXTILE RESEARCH.

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"I have noticed in the minutes of Subcommittee B–2 on Nomenclature and Definitions of Committee D–13 that there is a demand for a better name for the proposed Grex system. I am particularly interested in this because I have felt that Grex is not a good name—and in fact it is the only thing I have not liked about the proposed method.

"It seems to me that the word 'Universal'—or possibly a shorter word in Latin which means the same thing—would be more descriptive and euphonic.

"I wonder if any other readers of TEXTILE RESEARCH have suggestions for a better name."—KENNETH B. COOK, vice-president, Manville Jenckes Corp., Manville, R. I.

# ABSTRACTS

*Members of Textile Research Institute, Inc., desiring complete copies of articles abstracted may obtain photostat copies at cost by addressing the Institute's office, 10 East 40 St., New York 16, N. Y. The price of a photostat negative is seldom more than 30 cents per page of original text.*

*Translations of articles appearing in foreign language publications and abstracted in* TEXTILE RESEARCH, *will be furnished at cost when the original publication is obtainable.*

*A list of periodicals abstracted in* TEXTILE RESEARCH *and the abbreviations used appeared on page 32 of the January, 1944 issue of* TEXTILE RESEARCH.

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## ANALYSIS: TESTING LABORATORY METHODS

### Light Fastness

**The historical background of the new standards for light fastness.** W. H. Cady. *Am. Dyestuff Reptr.* 33, 29–32 (Jan. 17, 1944).

Except for the work of Chevreul about 1840, investigations related to dye fading have been confined to the last sixty years. Results of the most important of these researches are summarized. It was shown by Chevreul that the presence of air and moisture is necessary for light to have real fading action, and it was later (1891) demonstrated that certain acid gases in the air have strong influence on the deterioration of dyes. Non-uniformity both in rate of fading of certain dyes and in the actual fading action of sunlight was recognized at an early date and the need for standardizing the sun test was clear. In 1923 it was found by measuring foot candle hours of light that the intensity of the sunlight did not necessarily correspond to the amount of fading, and it was later determined that there was comparatively little variation in the fading by the sun if the samples were exposed between the hours of 9 a.m. and 3 p.m. on sunny days from April 1 to October 1. Many attempts have been made to duplicate sunlight in fading tests by the use of such devices as the white flame arc, mercury quartz lamps, a gas filled tungsten lamp in conjunction with a copper sulfate filter cell, and the violet carbon arc. The last named is in wide use under the name "Fade-Ometer" and as its intensity (ten inches from the arc) is only very slightly stronger than the midsummer sun, the abnormal results of more powerful lamps are avoided; its chief defect is lack of uniformity in the fading from lamp to lamp (of the same type) and from time to time in the same lamp. Because of the variable character of fading, standards are necessary as controls and such standard dyeings, graded in sets from fugitive to fast, have been made and are being used by English, German and American dyers. It now appears probable, however, that the work which has recently been done with blended wools will result in an entirely new set of official standards in the near future.

### Surface-Active Agents

**Surface-active agents, I—Definitions, surface tension measurements and their application. II—Empirical test procedures.** Earl K. Fischer. *Soap San. Chem.* 19, 25–9, 53 (Dec. 1943); *ibid.* 20, 28–31, 67, 69 (Jan. 1944).

A review of common laboratory test methods which can be employed effectively to determine applicability of various surface-active agents.

### X–Ray Diffraction Apparatus

**An automatic X-ray diffraction apparatus** W. P. Davey, F. R. Smith and S. W. Harding. *The Review of Scientific Instruments* 15 (Feb. 1944).

A description is given of an X-ray diffraction apparatus which automatically records, in the form of an inked graph on a moving strip of coordinate paper, diffraction patterns made by substantially pure Mo K-alpha X-rays. Balanced filters of Zr and Sr are automatically inserted in the path of the incident beam of a Mo-target X-ray

tube during alternate "useful" half-cycles of the half-wave rectified 60-cycle 42-Kv circuit. The intensities of the two sets of diffracted beams are measured by a Geiger-Mueller quantum counter, one set of data is electrically subtracted from the other, and the difference is automatically recorded in the form of an intensity vs. angle graph.

### Viscosity Determination

**Cupriethylene diamine as a solvent for precise determination of cellulose viscosity.** R. S. Hatch. *Ind. Eng. Chem. Anal. Ed.* **16**, 104–7 (Feb. 1944).

A modification of the tentative standard A.C.S. method for the precise determination of cellulose viscosity has been developed, using a new solvent cupriethylene diamine. The method has been rigorously compared with the A.C.S. tentative standard method and a correlation curve showing the relationship between viscosities determined on a 1% cellulose dispersion in cupriethylene diamine solvent and a 2.5% cellulose dispersion in cuprammonium solvent.

### Spectrophotometry

**Spectrophotometry and the colorist.** E. I. Stearns. *Am. Dyestuff Reptr.* **33**, 1–6, 16–20 (Jan. 3, 1944).

The application of the General Electric automatically visual range spectrophotometer (referred to as "VS") to problems related to the textile industry is discussed. By means of this instrument a curve is produced which measures the ratio of the amount of light, separated into its spectral colors, reflected by the sample to the amount reflected by a white standard. The curve is capable of colorimetric and analytical interpretation. The color terms "brightness," "dominant wave length" and "purity" are derived from VS data and therefore by this means scientific measurement and description of color is obtainable. Though, for reasons listed, the measurements are of limited practical help in actual dyehouse color matching, the terms may be of assistance in developing a universal color language, and are especially suited to the establishment of permanent color standards. Since each dye has a characteristic VS curve shape, it is usually possible to tell from a given curve what dyes and how much of each was used, and thus the analytical uses of the instrument are many. Some of the more important applications in which the VS may function as a tool to assist the dyer are (1) Standardization of dye shipments from the same manufacturer, (2) measurement of all types of dye fastness, (3) maintenance of standard samples, (4) determinations of tolerances of dyed samples in colorimetric terms, (5) dye identification, (6) determination of optimum dyeing conditions, (7) measurements of exhaustion rates and (8) measurement of infra-red reflectance. Actual VS curves illustrating these and other research and production problems are presented and interpreted.

## CHEMICAL AND PHYSICAL RESEARCH

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### Amorphous Cellulose

**A study of the amorphous portion of dry swollen cellulose by an improved thallous ethylate method.** A. G. Assaf, R. H. Haas and C. B. Purvis. *J. Am. Chem. Soc.* **66**, 59–65 (Jan. 1944).

Cellulose treated with thallous ethylate in an inert non-swelling solvent should be thallated on the hydroxyl groups of the amorphous portion only. The thallous cellulosate is then methylated and the methoxy group determined, thus giving a determination of the amorphous cellulose. Amorphous cellulose is defined to be the percentage wetted by an ether of zero molecular volume and was estimated by extrapolating the linear methylation-molecular volume plots of three or more straight chain ethers. The amorphous fractions of swollen linters samples were as high as 27% ± 2%, but the amount present in unswollen fibers was of the order of 0.25 to 0.5%.

### Antiseptic Efficiency

**Effect of increase in acidity on antiseptic efficiency.** Otto Rahn and Jean E. Conn. *Ind. and Eng. Chem.* **36**, 185–7 (Feb. 1944).

Benzoic acid, salicylic acid, and sulfurous acid are nearly a hundred times as efficient antiseptics in strongly acid solutions as

they are in neutral solutions. With benzoic and salicylic acids, only the undissociated acid is antiseptic; the benzoate and salicylate ions appear to have practically no effect on yeast. Multiplication of the yeast was inhibited whenever the undissociated benzoic acid concentration was above 25 mg. per 100 ml. With salicylic acid the limiting concentration was 4 mg. of undissociated acid per 100 ml. Sulfur dioxide in water dissociates to harmless $SO_3^{--}$ ions, and $HSO_3^-$ ions which inhibit the multiplication of *Bacterium coli* but not of yeast. The yeast is inhibited only by undissociated $H_2SO_3$. The rapid death of yeast is brought about by 7 to 8 mg. of undissociated $H_2SO_3$ per 100 ml.; *Bacterium coli* can tolearte nearly ten times as much.

## Calcium Laurate—Laurylsulfate

**Mixed calcium salts of soaps and anionic detergents.** Gilbert D. Miles and John Ross. *Ind. Eng. Chem.*, **35**, 1298–1301 (Dec. 1943).

Chemical analysis and microscopic study of crystals indicate the formation of a mixed calcium salt of lauric acid and lauryl sulfonic acid. The mixed salt decreases the foam formation and detersive properties of the solution. Magnesium does not give a similar mixed salt. Experimental evidence indicates that similar calcium salts are formed with other fatty acids and fatty sulfonates.

## Cellulose and Water

**A new interpretation of the cellulose-water adsorption isotherm and data concerning the effect of swelling and drying on the colloidal surface of cellulose.** A. G. Assaf, R. H. Haas and C. B. Purvis. *J. Am. Chem. Soc.* **66**, 66–73 (Jan. 1944).

The moisture adsorption isotherms at 20° or 25° C. of three highly swollen cotton linters were determined. The moisture content at the second region of inflection, occurring at a relative humidity of about 50%, was approximately that predicted by assuming the adsorption of one water molecule by each accessible alcoholic group, equivalent to a mono-molecular water layer on the accessible cellulose surface. The moisture content at the first region of inflection, occurring at approximately 10% relative humidity, was approximately one-third the value of the second inflection. This fact suggests that the avid adsorption of water up to the first inflection point was mainly a function of the strong hydrogen bonding capacity of the accessible primary alcoholic group. Up to 98% of the surface of moist swollen cellulose was obliterated by direct drying, but up to 75% was preserved during solvent exchange with ethanol.

## Degradation of Cellulose

**Degradation of native cellulose with mineral acids in the presence of acetic acid.** Arnold Marschall and H. Stauch. *J. Makromol. Chem.* 1, no. 1–6, 55–75 (Aug. 12, 1943). (Through *Bull. Inst. Paper Chem.* **14**, 161).

The raw material for this investigation included two cotton linters (D.P. 863, 1780), a rayon pulp (88% $\alpha$-cellulose, D.P. 897) and a refined pulp (96% $\alpha$-cellulose, D.P. 1080). These were treated with acetic acid containing 1, 2 and 4% sulfonic acid or 2% perchloric acid at 30 or 40° for 2, 4, 15 and 72 hours and examined for D.P. (nitrate method), alkali solubility, formic acid-zinc chloride solubility and sulfuric acid content. The amount of combined sulfuric acid was a maximum after the 2-hr. treatment and after 72 hrs. had decreased about 25%. The alkali solubility (compared at the same D.P.) did not increase in proportion with the acid concentration and was greater for the sulfuric than the perchloride acid treatment (especially for the linters of lower D.P.) Alkali solubility data are given also for aqueous acids (2N sulfuric, 2 N perchloric and N hydrochloride acids); in this case the perchloric acid gave higher solubility values (excepting for the linters with D.P. 1780). The yields of cellulose with 1 and 4% sulfuric acid in acetic acid were 87–95% after 2 hours and 62–76% after 72 hours; with the aqueous acids or with acetic acid alone the yields were about 97%. These differences are explained by the change in fibrous structure in sulfuric-acetic acid, the fibers being degraded to fragments (illustrated by photomicrographs). Drying of the sul-

furic-acetic acid treated material decreased the alkali solubility. A study is reported also of the glucose number of the above cellulose preparations, using the reversible Methylene blue method; the sulfuric acid could not be determined by this method.

## Color and Constitution

**Color and constitution, Part VII—some observations on the structures of the mono- and di-nitronaphthylamine based on their visual colours.** Hodgson and Turner. *J. Soc. Dyers and Colourists* **59**, 218–20 (Oct. 1943).

The mononitronaphthylamines can each resonate into one of the seven quinonoid structures, and since of the thirteen known compounds all are red, except the 2-, 3- and 4-nitro-1-naphthylamines which are yellow, it is suggested that the ten red isomerides have a double bond. In harmony with this viewpoint, the red B-naphthaquinone should also possess a central single bond and not the usually accepted Erlenmeyer formulation. The structures of the dinitronaphthylamines are discussed from the above standpoint. Finally the color effects produced by halogen substituents in the mononitronaphthylamines are considered.

## Emulsion Polymerization

**The pH of mixtures of aqueous soap solutions and monomers.** Charles F. Fryling and Edwin W. Harrington. *Ind. and Eng. Chem.* **36**, 114–7 (Feb. 1944).

The addition of monomers to aqueous soap solutions is accompanied by two changes in pH; an initial decrease which is attributed to solubilization, with the formation of micelles in the aqueous phase, is followed by an increase which is the result of solution of fatty acids in the monomer phase. This phenomenon lends support to the theory that the emulsion polymerization of synthetic rubber is initiated in the aqueous phase, and not at the interface or in the monomer phase. Other experimental facts in support of this theory are presented. It is suggested that the formation of micelles in aqueous solution is an important factor in the initiation of the reaction.

## Cuprammonium Dispersions

**Observations on the causes of turbidity in dispersions of cotton and modified cotton in cuprammonium.** G. F. Davidson. *J. Text. Inst.* **34**, T97–102 (Nov. 1943).

The author studied the possible causes of turbidity in cuprammonium dispersions of raw and alkali-boiled cottons which were reduced to a powdery hydrocellulose by the action of hydrochloride acid; a portion of both hydrocelluloses was extracted with chloroform to remove the wax. From these four types cuprammonium dispersions were prepared, and the insoluble material separated and examined. The insoluble portion of the hydrocellulose prepared from raw cotton was found to contain 60% of cotton wax and evidence of the presence of a pectic substance was obtained. This hydrocellulose, after extraction with chloroform, gave an insoluble residue that was practically free from wax but contained pectic substance, whereas the insoluble portion of the hydrocellulose made from alkali-boiled cotton consisted almost entirely of cotton wax. The proportion of material insoluble in cuprammonium ranged from 0.68% (found in hydrocellulose prepared from raw cotton) to 0.05% found with the chloroform-extracted hydrocellulose prepared from alkali-boiled cotton); this latter amount caused only a very slight turbidity in a 2% dispersion of the hydrocellulose. Farr reported that the suspended matter obtained from cuprammonium-hydrocellulose dispersions of raw cotton gave the x-ray diffraction pattern of cellulose and concluded that it consisted of undissolved hydrocellulose. The results obtained in the present investigation provide no support for this view, at least so far as dilute dispersions are concerned. The amount of cellulose which can be dissolved in a cuprammonium solution is limited and depends on the copper concentration. With the cuprammonium employed in the present work, the limiting ration of hydrocellulose to solvent was found to be between 4 and 5 grams per 100 cc.

## Reduction of Indanthrone

**The reversible reduction of indanthrone and other anthraquinonoid vat dyes.** D. A. Clibbens. *J. Soc. Dyers and Colourists* **59**, 275–9 (Dec. 1943).

The work of Geake on the constitution of indanthrone and other diquinones and their

reduction products is recalled in the light of the recently published paper of à Brassard dealing with the behavior of indanthrone in the hydrosulfite vat. It is pointed out that Geake showed that the reduction of indanthrone was not necessarily as abnormal (because it requires only one half as much hydrosulfite per mole for reduction as would be expected) as at first appears, if the theory accounting for the surprising stability of the half-way reduction products of many anthraquinonoid vat dyes be understood. The author discusses this theory at length. The essentially unique feature of indanthrone is merely that the energy of reduction of the second half of the complete reversible reduction to a di-hydroquinone is even greater than for other di-quinones. It is shown that the number of resonance structures contributing to the stability of the half-way reduction products of anthraquinonoid vat dyes is large. In the case of indanthrone it is evident that the exceptional stability of the half-way stage derives in part from the fact that many of its resonance structures do not contain paired electrons.

## Action of Solvents

**Mechanism of solvent action.** Arthur K. Doolittle. *Ind. Eng. Chem.* **36**, 239–44 (March 1944).

Two principal equilibria are simultaneously operative in the solution of resinous substances—solvation-desolvation and aggregation-disgregation. The rate of desolvation is substantially fixed at constant temperature, but the rate of solvation is a function principally of solvent concentration. The threshold concentration required to initiate the solution process diminishes to a constant minimum value as we ascend a homologous series of solvents. This minimum value, called "class threshold concentration," is independent of the diluent and therefore serves as an absolute comparison of different classes of solvents for a given resinous substance. The aggregation-disgregation equilibrium of the solute macromolecules depends on the solvation-desolvation equilibrium, since disgregation results when the "active centers" are solvated. In fluid solutions the extent of aggregation of the solute macromolecules increases linearly with decrease in solvent concentration; but as solvent concentration approaches the threshold value, desolvation permits aggregation at multiple points of contact. The result is either gelatin or precipitation. In film formation, the high viscosity, resulting from aggregation by means of gradual two- and three-dimensional growth as the resin desolvates during evaporation of the solvent, obstructs the tendency of the macromolecules to unite with one another at the maximum number of points of contact. A rather extended structure results. Plasticization prevents complete desolvation of the resin, and therefore diminishes the opportunity of the macromolecules to unite with one another at multiple points of contact. In this manner a less rigid structure is provided.

## Starch Studies

**The relation of starch-iodine absorption spectra to the structure of starch and starch components.** *J. Am. Chem. Soc.* **66**, 111–15 (Jan. 1944).

Study of absorption spectra confirms the great difference in behavior of amylose and amylopectin with iodine found by the potentiometric iodine titration, and provides another means of analyzing for the two components in whole starch. The differences in individual amyloses and amylopectins from different starches make a simple colorimetric analysis for the two components unreliable, however. The amount of iodine bound in complex formation with amylose increases as the concentration of iodide decreases, becoming one iodine molecule for six glucose residues for infinitely dilute iodide solutions. The wave length of maximum absorption of an amylose solution shifts toward the red as the chain length of the amylose is increased. The shift is in the same direction when the lengths of the unbranched portions of an amylopectin are increased. An increase in the molecular extinction coefficient accompanies an increase in the length of an amylose or an increase in the lengths of the unbranched portions of an amylopectin. Both these properties permit the relative evaluation of molecular weight of an amylose and degree of branching of an amylopectin. The change in the molecular extinction co-

efficient is the more sensitive. The relative molecular weights of a few amyloses and the degree of branching of some amylopectins have been examined. Results are in agreement with other determinations.

## Hygroscopicity of Starch

**Water sorption by starches.** L. Sair and W. R. Fetzer. *Ind. Eng. Chem.* **36**, 205–208 (Mar. 1944).

Cereal, root, tuber and pith starches differ in their hygroscopicity or the amount of moisture retention. Little attention has been given to this characteristic and its possible correlation to other properties of the starches. The present paper deals with this property among the various starch varieties of commerce. Sorption isotherms have been obtained for seven starch varieties on samples subjected to intensive dessication and also on unheated controls. From these data the starch varieties can be divided in three groups—namely, cereal, pith or root, and tuber. The results indicate that the sorptive capacity of a starch may be a measure of its degree of association. The sorptive capacity of tuber starches can be reduced to values similar to those found for cereal starches without causing injury or gelatinization of the granule. This reduction has been accomplished by treatment of air-dried potato starch for 3 hours with steam at a pressure of 5 pounds per square inch. This vapor treatment profoundly alters the properties of the tuber starches.

## Starch Studies

**The electrochemistry of starch granules. I. Cation exchange on potato starch granules.** Jaroslav Dykyl and Jan. Bena. *Kolloid-Z.* **104**, No. 106–12 (July 1943). (Through *Bull. of the Inst. of Paper Chem.* **14**, 188.)

According to the authors, starch undergoes base exchange reactions similar to those of certain natural and synthetic silicates and resins. However, the action in the case of starch is confined to the surface of the granules. Because the nature of the cations in the electric double layer influences the properties of the starch, many of the conflicting data of starch chemistry obtained under apparently the same conditions might be explained on the basis that the base-exchange equilibrium was not always considered. A study of the change of $Fe^{+++}$ and $Ca^{++}$ ions on potato starch granules was made and the results were expressed mathematically in an equation derived from the law of mass action with ion activities substituted for solution concentrations. 23 references.

## Studies of Wool with Electron Microscope

**Structure of the wool fiber as revealed by the electron microscope.** Charles W. Hock and Howard F. McMurdie. *J. Res. Natl. Bur. Standards* **31**, 229–36 (Oct. 1943). Condensed in TEXTILE RESEARCH **13**, 15–20 (Oct. 1943).

An investigation of the wool fiber with the electron microscope was undertaken in order to get more data on the structure of the fiber and its constituent cells, and to correlate this information with results previously obtained by other methods. Specimens were prepared for examination by various physical and chemical procedures. Over a wide range of magnifications the cortical cells always showed a distinctly fibrous structure. Whereas with the optical microscope only fibrils were observed within the cortical cells, the higher resolving power of the electron microscope made possible the resolution of still finer microfibrils. The scale cells, on the other hand, showed little internal organization. This difference in structure between the fibrous cortex and the nonfibrous or amorphous cuticle is believed to be of fundamental importance in interpreting many of the properties of the fibers.

# DYEING: BLEACHING: FINISHING

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## Package Dyeing

**Practical dyeing by the pack system.** T. E. Clarke. *Am. Dyestuff Reptr.* **32**, 551–4 (Dec. 6, 1943). (From the *Textile Journal of Australia.*)

Dyeing by the pack system usually results in considerable saving of steam, dyes and drugs, and this is particularly true of vat dyeing. When dyeing sulfur colors by this

method, complete solution of the dyestuff is essential. It is suggested that the smallest amount of sulfide needed to produce a clear solution, found experimentally, be used since an excess in conjunction with the reducing action inherent in centrifugal pump machines may cause precipitation of the dye. The author recommends adding dissolved dyestuff while the circulation of the machine is from outside-in, rather than the reverse direction, since in this way remaining particles of dyestuff have a greater opportunity to become dissolved. It is found that stripping in a machine is proportionately more difficult than in a long liquor bath and several fresh baths may be necessary.

## Hydrosulphite Ager

**Temperature control in the hydrosulphite ager.** A. R. Urquhart. *J. Text. Inst.* 34, T–103–124 (Dec. 1943).

It was early apparent that the normal thermometric equipment of an ager was inadequate, and as a result an electrical thermometer for use in the ager was designed. With this instrument, temperature conditions in the ager have been systematically explored, and a number of interesting results have been obtained. It has been found, for example, that there are considerable differences of temperature between different parts of the ager, and that the temperature at any one point is higly dependent on the cloth passing through. In addition, a few large scale experiments have been conducted which have shown that a large part of the heat evolved in the ager must be ascribed to the heat of dilution (or solution) of the alkali in the paste. The latter part of the paper deals with the question of the fixation of the dyestuff from a more fundamental point of view, and a few tentative suggestions for improving the efficiency of the process are put forward.

## Cellulose Ethers

**Finishing with alkali soluble cellulose ethers and some recent developments in their use.** J. Andrew Clark. *Am. Dyestuff Reptr.* 33, P9–P13 (Jan. 3, 1944).

"Ceglin" is the trade name of an alkali soluble cellulose of the type first prepared by Lillienfeld, now being used as a durable, laundry fast, additive textile finish. It is produced by the action of chlorohydrin or ethylene oxide on properly aged alkali cellulose. Obtainable in several viscosities for varying requirements, the cellulose ether in the form of a fluffy white fibrous material is first dissolved in cold dilute caustic soda, then applied to fabric by means of one of several types of standard mill equipment, and coagulated on the cloth either by acid or by drying treatment. Because of its permanent nature, the Ceglin treatment may be introduced at any convenient stage of processing and is commonly applied to the grey material; it is even possible to utilize the mercerizing bath to bring about coagulation of the Ceglin. A variety of finishes are producible on cotton and rayon. Other uses for Ceglin include permanent stiffening for interlinings, binding for backfilling and pigment colors, and most recently, in warp sizing. The latter treatment is described in some detail and its advantages noted.

## Water-Repellent Textiles

**Process for producing water-repellent synthetic textiles.** *U. S. Patent Office Official Gazette* 557, 87 (Dec. 7, 1943).

Outlines second of six accepted claims for U. S. Patent 2,335,980 granted Dec. 7, 1943 to Ernst Waltmann, Krefeld, Germany, assignor by mesne assignments to the E. I. du Pont Co., Wilmington, Del. Claim describes a process for producing water-repellent synthetic sheets, filaments and the like of cellulose by preparing an aqueous cellulose spinning solution containing a water-soluble quaternary ammonium compound of the general formula $Z-CH_2-N_t-X$ — wherein X is a halogen atom, $N_t$ is the radical of a volatile tertiary amine whose nitrogen atom has become pentavalent, by attachment to the $CH_2$ group and atom X. Z signifies an aliphatic radical of at least 10 carbon atoms which is free of water solubilizing radicals and is attached to the $CH_2$ group through the agency of a trivalent nitrogen atom. This solution is then extruded thru an orifice; a cellulose regenerating treatment is applied to it. The resultant mixture is heated to split off the tertiaryamine represented by $N_t$.

## FIBERS: YARNS: FABRICS: MECHANICAL PROCESSES

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### Synthetic Fiber Patents

**Synthetic fiber production research in 1943.** A. Tsimehc. *Silk J. Rayon World* **20**, 22–24 (Jan. 1944).

During the past year there have been no spectacular advances in the production of artificial fibers. Except for the news of "Bubblfil" as a remarkable substitute for kapok, there has only been a general consolidation of knowledge in well-defined directions. The author reviews the patents, as well as some of the important research papers, appearing during 1943 on the following subjects: viscose, nylon, cellulose ether fibers, and protein fibers.

### Strength of Cotton Yarns

**Relation of cotton fiber properties to yarn strength.** Anon. *Rayon Text. Mo.* **24**, 51–2 (Dec. 1943); *Ibid.* **25**, 65–6 (Jan. 1944).

The effects of yarn twist, fiber strength, fiber length, surface area, fiber fineness, and surface fibers on the strength of cotton yarns are considered in a theoretical discussion.

### Wearing Qualities of Rayon Hose

**Wearing qualities of viscose, cuprammonium, and acetate rayon hose.** Hazel M. Fletcher. *Rayon Text. Mo.* **25**, 66–7 (Feb. 1944); *ibid.* 76–8 (Mar. 1944).

Actual wear tests were conducted on three kinds of rayon hose also laboratory analyses were made. Results are shown. 54 pairs of rayon hose were worn by 15 different people. These included 18 pairs each of viscose, cuprammonium, and acetate rayon. The viscose and cuprammonium were quite similar in performance. Because of the inherent properties of acetate the acetate hose held their shape, fitted snugly around the ankle and did not bag at the knee. These hose were somewhat more resistant to snagging than either the viscose or cuprammonium. However, holes were more readily worn in the acetate. The acetate hose did not wear as long as the viscose and cuprammonium. The viscose hose were worn an average of 330.60 hours. The statistical analysis showed that one kind of rayon hose was not significantly superior in wearing qualities. Considerable variability in the length of time worn was found for each kind of hose. The statistical analysis of the bursting strength data of the controls showed no significant differences among the three kinds of hose. In the worn hose there was no significant difference in bursting strength of the viscose and cuprammonium but each was greater than the acetate. The viscose and cuprammonium showed no significant differences in fading and each faded more than the acetate. The lesser fading of the acetate was probably due to the smaller number of launderings. The load-elongation characteristics of the yarns showed differences in their performance. All yarns of the different brands of viscose were nearly identical. The curves of the viscose and cuprammonium were similar to each other but unlike the acetate which resembled the characteristics of wool yarns.

### Feather Fabrics

**Method of making a feather fabric.** *U. S. Patent Office Official Gazette* **556**, 648 (Nov. 23, 1943). (Through *Technical Abstracts* 1943, 11, 926.)

U. S. Patent 2,335,011 granted Nov. 23, 1943 to E. Hulvey, Mount Crawford, Pa., describes a method of making a feather fabric by laying feathers longitudinally in rows on a cloth backing with the barbs of the laterally adjacent feathers overlapping. The feathers are stitched in place by passing stitches through the cloth and laterally through the quill of the feathers. Before stitching the quills are first crushed.

## MISCELLANEOUS

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### Future of Cotton Spinning

**A long range look into the future of cotton spinning.** E. C. Gwaltney. *Textile Bulletin* **65**, 15–18, 58–60 (Feb. 15, 1944).

In this article by the director of research of the Saco-Lowell Shops, the author states "the future that is the subject of these remarks is not the immediate future dominated by war conditions, nor the

period following the war when the world is recovering from this upheaval and trade channels are still affected by abnormal conditions. . . . The purpose of this discussion is to try to determine what our position will be 'in the cold gray dawn of the morning after' and what, if anything, can be done to improve our competitive position as spinners of cotton or synthetics."

## New Fatty Acids

**New fatty acids. Azelaic and pelargonic acid developed commercially through accelerated war research.** L. D. Myers. *Soap San. Chem.* **19**, 37 (Nov. 1943).

Azelaic acid, one of the newly developed organic acids, is now commercially available. Its formula $(CH_2)_7(COOH)_2$ shows nine carbons in the chain with a carboxyl group at each end. Its combining weight is 93 to 95. The commercial product is a fused, flaked solid, light tan in color which melts at approximately 96° C. Slightly soluble in cold water, it is infinitely soluble in hot water. It is also soluble in cold alcohol and other strongly polar solvents. It reacts readily with cold solutions of such weak alkalies as sodium bicarbonate. The esters of azelaic acid, particularly those made from the monohydric alcohols and alcohol ethers, are characterized by high boiling points and are compatible with many of the synthetic resins. The properties of the compounds suggest diverse fields for investigation including textiles, modifying of resins, plasticizers for protective coatings, etc.

## Flexible Plastics

**Flexible plastics.** J. B. Price. *British Plastics* **15**, 284–91 (Oct. 1943).

The advantages of plasticized vinyl chloride-acetate resins over rubber and other flexible materials are discussed. One of the most important uses of these vinyl elastic plastics is to be found in the calendar-coating of cloth for Army and Navy needs. Army raincoats, as well as inflatable equipment and tarpaulins of many types, are now water-proofed with this material. Such coatings do not become brittle, but retain their flexibility at temperatures as low as —50° F. On the other hand they do not become sticky in hot climates. Also, they do not develop disagreeable odors after prolonged storage or use. Cloth coated with vinyl plastics is usually much lighter than cloth coated with rubber. Whereas rubber-coated raincoats require 6 to 10 oz. coating/square yard, as little as 2½ to 3 oz. of vinyl compound is needed.

## Cotton Variety Tests

**Cotton variety tests in the Mississippi Delta.** J. Winston Neely and Sidney G. Brain. *Bulletin*, Mississippi State College Experiment Station, State College, Miss. (Feb. 1944).

The data from the six cotton variety studies conducted in 1943 by the Delta Branch Experiment Station in Stoneville, Marks, Money, Heathman, Valley Hill, and Yazoo City, were combined and analyzed and the results are given.

## Research in the Navy

**Mobilization of scientific resources—IV. The U. S. Navy.** *J. Applied Physics*, 15, 203–90 (Mar. 1944).

A series of papers is presented describing the broad organization of research in the Navy, illustrated in many cases with examples which are being made public for the first time. The papers were prepared by high ranking officers of the Navy and the subjects are as follows: Organization of the U. S. Navy; Research in the Navy; Research in the Bureau of Ships; U. S. Naval Research Laboratory; David W. Taylor Model Basin; Naval Boiler and Turbine Laboratory; U. S. Navy Radio and Sound Laboratory; Navy Yard Laboratories; Research in the Bureau of Ordnance; Research Activities of the Naval Ordnance Laboratory; Research and Experimental Activities of the U. S. Naval Proving Ground; Research in the Bureau of Aeronautics; Naval Air Material Center, Philadelphia, Pennsylvania; Research in the Bureau of Supplies and Accounts; Research in the Bureau of Medicine and Surgery of the U. S. Navy; Research Activities of the Bureau of Naval Personnel.